



Tech Brief

Pavement Thickness Design for Local Roads in Iowa

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RESEARCH PROJECT TITLE:

Pavement Thickness Design for Local Roads in Iowa

SPONSOR:

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PRINCIPAL INVESTIGATOR:

Hosin "David" Lee, Ph.D., P.E.
Public Policy Center
Associate Professor of Civil and Environmental Engineering
University of Iowa
319-335-6818
hlee@engineering.uiowa.edu

TECHNICAL ADVISORY COMMITTEE:

Chris Brakke, Iowa DOT
Donna Buchwald, Iowa DOT
John Dostart, Iowa DOT
Cathy Nicholas, Black Hawk Co.
Myron Parizek, Benton Co.
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Objectives

The main objectives of this research are to: 1) identify the most critical design input parameters, 2) determine the minimum pavement thickness, and 3) develop new pavement design and sensitivity analysis (PD&SA) software which can provide the most appropriate design thickness for a broad range of pavement conditions.

Problem Statement

To minimize the life-cycle cost of building and maintaining pavements, it is critical to determine the most appropriate pavement material and thickness for a given traffic level, subgrade condition and environmental factor. The AASHTO 1993 guide for design of pavement structure is most commonly used by states for designing pavement thickness for low-volume roads. Statewide urban design and specifications (SUDAS) currently utilizes a simplified version of the AASHTO 1993 pavement design guide in Iowa, which is very conservative based on placement of the pavement on natural subgrade, distribution of truck classifications, and other design parameters. Therefore, there is a need for a modified pavement design methodology to be used for determining local road pavement thickness in Iowa.

Research

A survey was performed to identify the minimum thicknesses of asphalt and concrete pavements and the pavement design methods for low-volume roads. The survey was completed by State DOT's. StreePave, WinPas, and APAI software packages were used to compare their impacts on the pavement thickness design. Based on the current pavement design procedures and sensitivity analysis results, a prototype pavement design and sensitivity analysis (PD&SA) software package was developed to allow a user to perform a pavement design sensitivity analysis. The PD&SA software uses the results from the WinPAS, StreetPave and APAI software to select the pavement thicknesses. The prototype Pavement Design and Sensitivity Analysis (PA&SA) software package was developed to demonstrate the concept of storing the pavement design results in the database for a design sensitivity analysis. The software would not be released until Darwin and the Asphalt Institute methods are included.

Benefits

The most critical input parameters were identified and their typical values for local roads in Iowa were used to run the existing StreePave, WinPas, and APAI pavement design software packages. The prototype PD&SA software can be used to make comparisons from the pavement design catalog that was developed for the database. Through the pavement design sensitivity analysis, the prototype PD&SA software will help pavement engineers understand the impacts of the critical input parameters on the pavement design.

Key Findings

Based on the limited research, the following conclusions are derived:

1. Based on the sensitivity analysis result of three pavement design software packages of WinPAS, StreetPave and APAI, a traffic level has the highest impact on pavement design followed by a subgrade strength, a reliability and a design life.
2. For the same condition for designing pavements, these three software packages recommended slightly different pavement thicknesses.
3. The prototype PD&SA software demonstrates the concept of storing the pavement design results in the database for a design sensitivity analysis.
4. The approach of storing the pavement design results for a typical set of conditions commonly found in Iowa would not only generate the pavement design thickness immediately but also allow a pavement designer to perform a pavement design sensitivity analysis instantaneously.

Recommended Refinements through Additional Research

Additional survey should be performed to local agencies in Iowa and surrounding States rather than State DOT's regarding the typical pavement thicknesses and their pavement design practices. This survey will be used to determine typical pavement thickness for asphalt and concrete pavements from local agencies. The PD&SA software package should be enhanced to include pavement design results from AASHTO Darwin and Asphalt Institute software packages. PD&SA software should be modified to provide a single pavement thickness value which can be adopted as a standard SUDAS design thickness for all cities and counties in Iowa. Design parameters should be refined in consideration of the current SUDAS design procedure.

